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An investigation into an Alleged Mass Mortality of Iceland Scallops, Chlamys islandica, off Perch Rocks, Placentia Bay, Newfoundland

by

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Abstract

An examination into the distribution and frequency of dead Iceland scallops, Chlamys islandica, compared to live scallops in an area off Perch Rocks, (Placentia Bay, Newfoundland) suggests that allegations of widespread and catastrophic mortality in the species to be unfounded. The ratio of cluckers to live scallops, even alloving for tow-induced disarticulation among dredge-caught samples, and computation of instantaneous natural mortality therefrom suggest that annual mortality of Iceland scallops in this area to be within the range of values commonly found in other populations in the Newfoundland area.

Résumé

Un examen de la distribution et de la fréquence des pétoncles d'Islande morts, Chlamys islandica, et des pétoncles vivants dans un secteur situé au large de Perch Rocks (baie de Placentia, Terre-Neuve) semble démentir les allégations de mortalité catastrophique à grande échelle au sein de l'espèce. La proportion de «claquettes» et de pétoncles vivants, même en tenant compte de la désarticulation provoquée par le trait parmi les échantillons capturés à la drague et le calcul de la mortalité instantanée qui en résulte révèlent que la mortalité annuelle des pétoncles d'Islande dans ce secteur est de l'ordre de celle que l'on enregistre communément dans d'autres populations de ce mollusque à Terre-Neuve.

Introduction

At the request of the Department of Fisheries, Government of Newfoundland and Labrador, a scientific investigation was conducted into an alleged epidemic mortality of Icelandic scallops in the Perch Rock area some 10 miles off St. Brides in Placentia Bay, Newfoundland (Fig. 1). A total of four excursions was made to the target area over a nine-day period between 15-24 October 1991. Most of the observations were made at sea during the course of normal commercial fishing operations.

Materials and Methods

A gang of four Digby buckets each approximately 64 cm (25 in) wide was employed throughout. Each bag was made up of wire loops measuring approximately 77 mm (3.0 in) in diameter. The wire loops were interconnected with (49 mm - 2.0 in) rubber links. The four rakes were attached to a single tow bar measuring 280 cm (9'2") and were towed in tandem. Tow-by-tow observations were kept. All live scallops and cluckers were weighed and counted. Weights and numbers of disarticulated valves were estimated from subsamples. Samples from each of the three categories were measured. Abundance of starfish and whelks, two common scallop predators, was also noted. Individual meats were extracted from a sample of scallops to determine overall condition and yield. Data on size-specific clucker gape were also assembled to determine synchronicity (if any) in the alleged mortality. Clucker gape, the distance between the right and left valves along the ventral margin perpendicular to the hinge line, was measured to the nearest millimeter. Mortality was computed using a technique proposed by Dickie (1955) using the equation:

$$M = 1 - e^{-\left(\frac{C}{t}\right)\left(\frac{1}{L}\right).365}$$

where c = number of cluckers, L = number of live scallops, t = time required for natural clucker disarticulation.

Results and Discussion

The majority of fishing was confined to an area approximately 10 mi² in waters ranging from 77 to 90 m (42-49 fm). The best catch was taken in a narrow depth range between 77 and 90 m (42-49 fm) (Fig. 2). As tows were of different duration, all observations are standardized to a 10-minute tow (Table I). Overall mean catch of live scallops/10 min tow was 8.8 kg (19.5 lb) corresponding to 1.4 kg (3.0 lb) meat. There was no evidence of severe pathology or emaciation in live (fresh) scallops. Meat yield and meat count data (Table II) are here included as items of interest and are not used in the analysis. Overall, cluckers represented less than 5% of scallops taken during the four fishing days. The ratio of dead to live scallops was not inconsistent with that normally found in other areas where some fishing activity (not necessarily directed at scallops) is or had been underway (Naidu 1988). Size-frequencies of live scallops, cluckers and disarticulated valves (Fig. 3) indicate that nearly all cluckers were >65 mm with a mean size of 79.3 mm.

Also, 79 out of 134 (or 59%) cluckers had lost gape (Table III) suggesting that they had been dead for some time. No discernible correlation was evident between clucker gape and shell size (SH) (Fig. 4). For a given size (SH) a wid variation of clucker gape was evident, again suggesting that deaths were more o less continuous rather than occasioned by a single catastrophic event.

Even allowing for tow-induced disarticulation (i.e. observed clucker numbers x 1.22 (see Naidu 1988), it is apparent that natural mortality computed form clucker:live scallop ratio (0.0967) is well within the range of values commonly observed in Newfoundland waters. With the exception of a cluster of points for scallops in the 70-90 mm range (Fig. 4), representing an accumulatio of long-dead scallops, there was no evidence to suggest that widespread epidemi or catastrophic mortality had occurred amongst scallops over the area. Etiological aspects of the deaths were not investigated.

Shell damage to cluckers was negligible (<10%) but was common among disarticulated valves. An estimated 80% of disarticulated shells were variously damaged. Typically, they were characterized by irregularly-shaped holes, particularly where the adductor muscle had once been attached. Again, this would suggest the operation extraneous factors such as fishing which over time undermine shell configuration in characteristic ways.

While mass mortalities of scallop populations have previously been reporte elsewhere for the sea scallop, Placopecten magellanicus (e.g. Medcof 1949, Dickie and Medcof 1963, Gulka et al. 1983) and in the calico scallop, Argopecte gibbus (Aber disease[1] caused by the protozoan Marteilia refrigens [Dr. N. Blake University of South Florida, pers. comm.]), we could find no published information pointing to catastrophic die-offs in Iceland scallops, other than the one involving intense predation by starfish, Asterias rubens (Brun 1968). Typically, mass mortalities involve all members of a population irrespective of size. In this instance only larger scallops were found to be dead but in numbers not inconsistent with those observed in natural populations of this species in Newfoundland waters. Selectivity for only larger cluckers can be discounted as many live scallops <60 mm were also encountered (Table IV). Senescence, predation and incidental (non-yield) mortality probably account for most of these deaths. The preponderance of disarticulated valves in the area i likely related to sporadic fishing. Their larger size ($\bar{x}$ = 84.8 ± 7.8 mm) compared to live scallops and cluckers ($\bar{x}$ = 78.0 ± 9.8 mm and $\bar{x}$ = 79.3 ± 8.0 mm respectively) suggests culling of small scallops by the fishery. Whereas there was no difference between the mean size of live scallops and cluckers ($t = 1.13 < t_{0.05} = 1.96$), mean shell size of disarticulated valves was significantly larger than both live scallops ($t = 20.1 > t_{0.01} = 1.96$) and cluckers ($t = 5.88 > t_{0.05} = 1.96$). Until recently, dragging for demersal fish in this area was widespread (Mr. Arnold Foley, St. Brides, Newfoundland, pers. comm.). In fact, information on the occurrence here of Iceland scallops first came from fish draggers which took scallops in the incidental catch and shucked them for personal use (J. Perrot, St. Lawrence, Newfoundland, pers. comm.). By all accounts, this area was reportedly popular with fish draggers.

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[1] Figueras, A. J., and J. Montes. 1988. Aber disease of edible oysters caused by Marteilia refrigens. In W. S. Fisher [ed.] Disease Processes i Marine Bivalve Molluscs. Amer. Fish. Soc. Sp. Publ. 18: 23-37.

Assuming that no spectacular changes had occurred in predator abundance (Brun 1968) (Table V), their numbers are not inconsistent with the lov rates of mortalities normally associated with predation and senescence in this species. In any case, unlike predation by finfish (Naidu and Meron 1986), starfish prey on a broad size range of scallops (K. S. Naidu, unpublished data). It is apparent, however, that a large number of disarticulated shells occur in the study area. This may have led new entrants into the fishery into suspecting th possibility of catastrophic mortality in the species. In addition to natural deaths through senescence and predation, disarticulated shells represent an accumulation of shells from sporadic fishery sometimes directed at scallops as well as incidental fishing mortality through widespread dragging for demersal finfish.

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TABLE I Distribution of scallop weights and numbers (live, cluckers and DVs) in fishing sets/standardized 10 min. tow.

	Weight (kg)			Numbers		
set	Live	Clucker	DVs	Live	Clucker	DVs/2
1	2.3	0.2	3.3	23.3	4.1	90.4
2	6.9	0.4	27.7	94.6	10.8	670.8
3	8.5	0.3	27.5	100.0	10.0	577.5
4	14.3	0.5	16.7	206.7	11.0	356.7
5						
6	3.0		15.0	30.5		247.5
7	2.9		15.7	42.9		324.3
8	2.3		9.4	32.5		301.3
9	9.8	0.1	15.0	99.5	2.5	306.0
10	22.7		55.0	277.3	12.0	980.0
11	10.5	0.2	14.5	134.7	5.8	304.0
12	8.3	0.1	16.5	101.0	3.0	318.0
13	9.0	0.1	16.7	102.7	5.3	355.0
14	13.9	0.7	19.6	190.7	17.1	432.9
15	7.5	0.1	13.1	100.6	2.5	249.4
16	21.7	0.8	27.5	271.7	26.7	702.9
17	15.0	0.4	20.8	175.8	15.8	429.2
18	10.0	0.2	16.7	118.9	5.6	319.5
19	17.7	0.8	20.2	219.2	15.4	401.9
20	5.0	0.2	9.4	67.8	6.1	158.4
21	12.9	0.6	18.6	158.6	12.1	224.0
22	3.5		3.2	42.9		67.4
23	8.0	0.1	12.0	104.0	2.7	241.0
24	14.1	0.1	12.5	175.0	2.5	265.0
25	10.8	0.4	9.0	124.8	6.8	228.0
26	3.3	0.1	8.0	50.0	0.7	235.0
27	6.2	0.1	13.8	93.8	3.8	349.3
28	13.6	0.1	10.0	277.1	2.9	287.5
29	10.6	0.2	17.1	207.1	7.1	310.0
30	16.4	0.2	15.0	280.0	6.4	318.6
31	7.8	0.2	9.8	98.1	5.6	435.0
32	3.9	0.1	18.3	45.0	2.8	179.2
33	6.6	0.2	7.1	93.6	0.4	170.6
34	8.1	0.2	8.3	111.1	7.8	250.0
35	3.0	0.1	7.5	41.0	1.0	172.5
36	15.8	0.3	16.0	200.8	11.7	320.9
37	6.9	0.1	60.0	76.2	1.5	1090.0
38	5.0		58.3	70.0		1230.9
39	4.6	0.1	39.4	57.5	1.7	870.0
40	5.8		26.3	67.5		457.9
41	4.2	0.1	10.0	50.8	1.7	200.0
42	6.7	0.3	32.1	80.0	7.5	630.0
43	13.8	0.3	22.9	157.5	10.8	485.4
44	8.8	0.2	12.7	98.5	3.8	271.2
45	19.6	0.2	16.7	230.8	4.2	385.0
Total	411.3	9.4	824.9	5382.1	259.2	17200.1
Means	9.3	0.2	18.7	122.3	5.9	390.9
Percent	33.0	0.8	66.2	23.6	1.1	75.3

Table II Biological meat yields, average meat weights and meat counts/500g of Iceland scallops (≥60mm) from Perch Rocks, Placentia Bay, Newfoundland.

Set	No.	Whole wt(kg)	Meat wt(g)	$\bar{X}$ meat wt(g)	% Yield	M/C(500g)
9	68	5.60	798	11.7	14.3	42.6
24	57	4.61	713	12.5	15.5	40.0
31	56	3.35	581	10.4	17.3	48.2
44	56	4.79	755	13.5	15.8	37.1
Ttl.	237	18.35	2847	12.0	15.5	41.6

Table III Proportions of gaping and collapsed Iceland scallop cluckers from Perch Rocks, Placentia Bay, Newfoundland.

Set	Gaping			Collapsed	
	#	$\bar{X}$ Sh.Ht. (mm)	$\bar{X}$ Gape (mm)	#	$\bar{X}$ Sh.Ht. (mm)
2	5	77	24.9	9	78
14	5	78	21.7	19	81
16	10	83	20.4	26	81
25	10	79	29.9	7	80
32	3	76	33.9	2	82
34	8	79	35.4	6	78
36	4	80	17.7	10	75
42	4	73	42.8	5	79
43	6	74	37.8	7	76
Totals	55 38%	78	29.4	79 62%	79

Table IV Size-specific frequency of live scallops, cluckers and disarticulated valves from dredge-caught samples of Iceland scallops from Perch Rocks, Placentia Bay, Newfoundland.

Shell ht. (mm)	Live	Clucker	DV's
15-19	1		
20-24	1		
25-29	2		
30-34	7		
35-39	7		
40-44	6	1	1
45-49	12		1
50-54	4		3
55-59	8		6
60-64	24	1	6
65-69	49	4	17
70-74	183	12	77
75-79	321	20	228
80-84	355	20	393
85-89	177	16	379
90-94	54	3	232
95-99	13	2	111
100-104			35
105-109			8
110-114			
115-119			1

Table V Predator numbers in fishing sets (standardized 10 min tows) at Perch Rocks, Placentia Bay, Newfoundland October 1991.

Set	$\bar{X}$ Depth (M)	$\bar{X}$ no. per standardized 10 min. tow	
		Starfish	Whelks
1	69.3	12.5	1.6
2	76.5		3.8
3	81.9	6.0	10.5
4	81.9	5.7	
5	84.0		
6	86.0		
7	101.0		
8	85.5	0.5	0.5
9	85.5	5.5	6.5
10	83.7	9.3	4.6
11	83.7	10.5	
12	86.0	1.0	2.5
13	80.1	2.7	
14	84.0	20.0	
15	81.9	5.0	6.9
16	82.0	7.5	3.3
17	84.0	12.5	2.5
18	84.0	6.7	
19	80.1	16.9	3.8
20	76.5	8.3	2.2
21	78.3	12.9	1.4
22	84.0	2.9	
23	85.5	5.3	1.3
24	83.7	3.1	6.9
25	81.9	6.4	2.8
26	82.0	3.3	1.3
27	84.0	14.6	1.5
28	83.7	9.3	
29	86.0	19.3	5.0
30	85.5	15.0	12.1
31	85.5	6.3	6.9
32	87.3	3.3	10.0
33	84.0	7.9	1.6
34	90.0	10.0	3.9
35	87.3	1.0	
36	87.3	6.7	7.5
37	92.7	1.5	3.8
38	92.7	1.7	0.8
39	89.1		3.3
40	90.0	1.7	1.7
41	81.9	1.7	4.2
42	84.0	1.7	4.2
43	81.9	5.8	4.2
44	84.0	3.3	
45	83.7	5.8	4.2
Totals	84.3	6.0	3.0

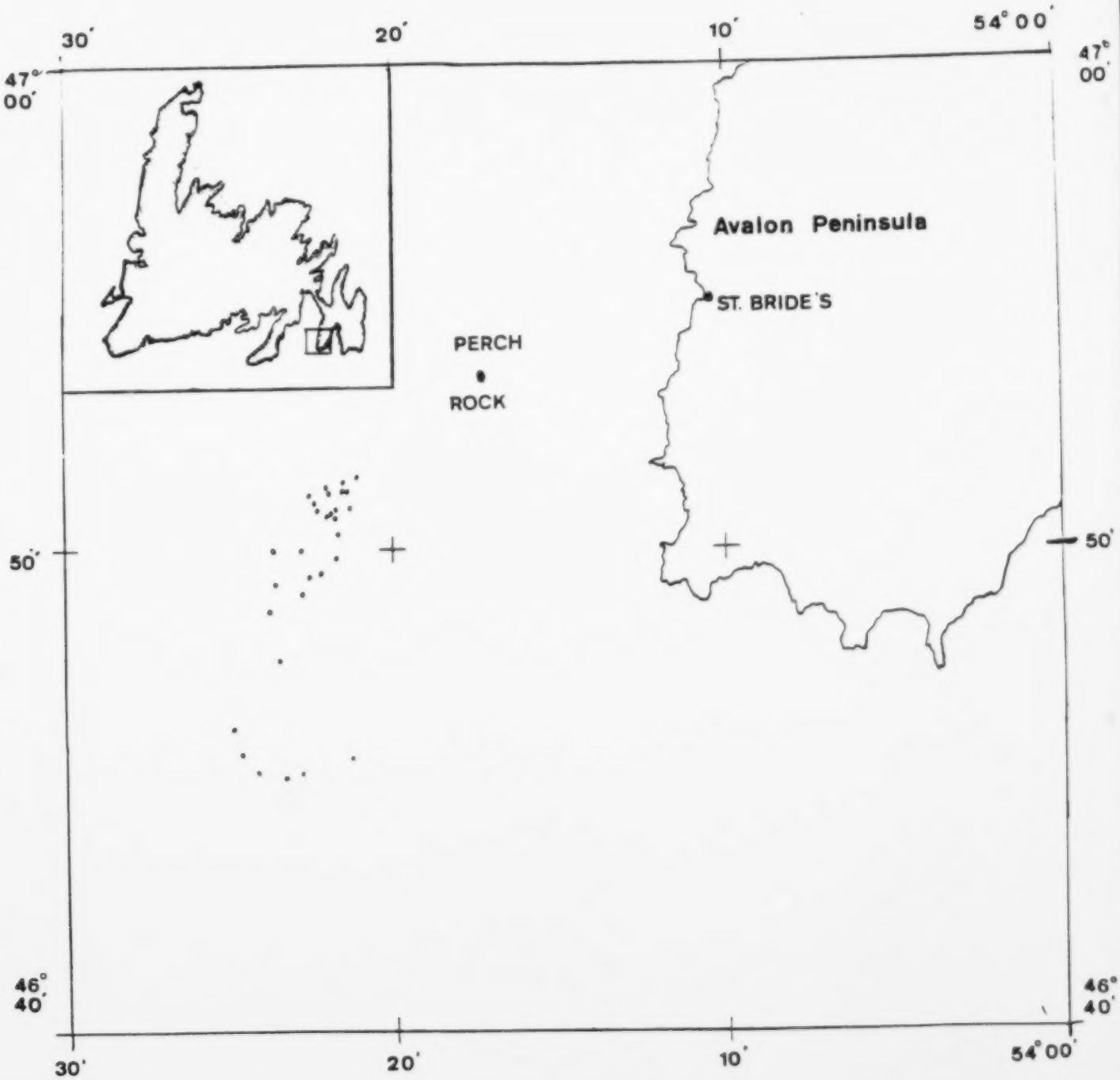

Fig.1. Approximate distribution of sampling stations in study area (see inset), off Perch Rocks, Placentia Bay, Newfoundland, October 1991.

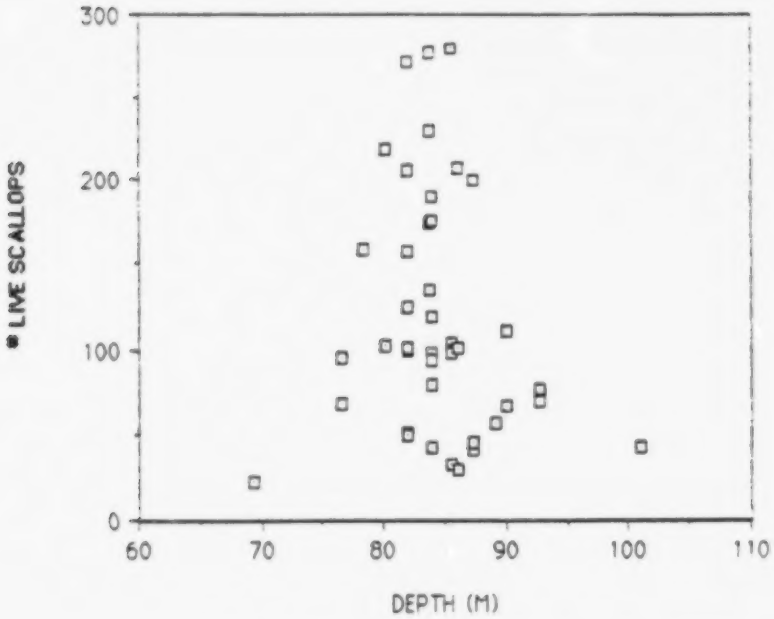

Fig.2. Number of live scallops/10-minute tow off Perch Rocks, Placentia Bay, Newfoundland, October 1991.

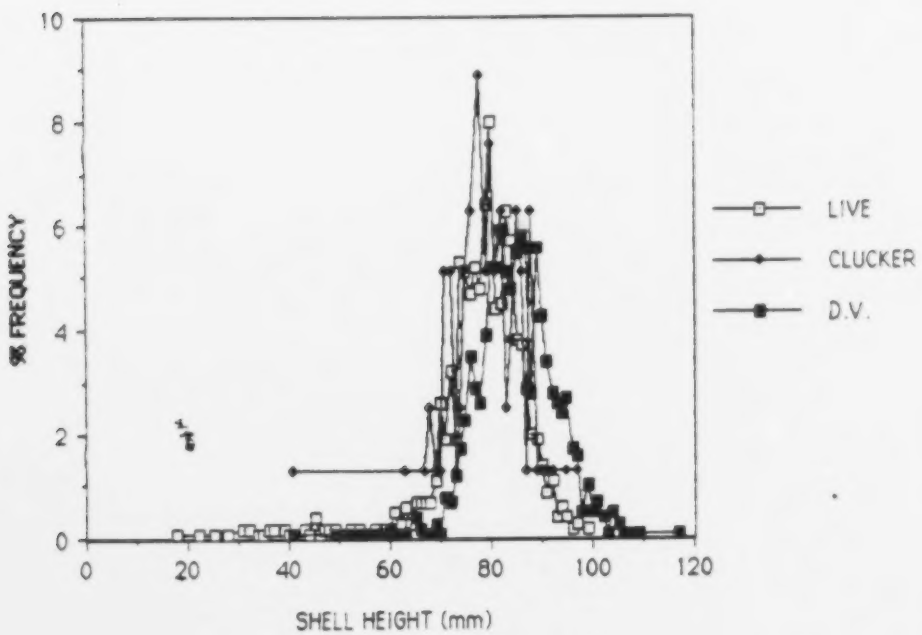

Fig.3. Size (SH)-frequencies of live scallops, cluckers and disarticulated valves (DVs) of Iceland scallops from Perch Rocks, Placentia Bay Newfoundland, October 1991

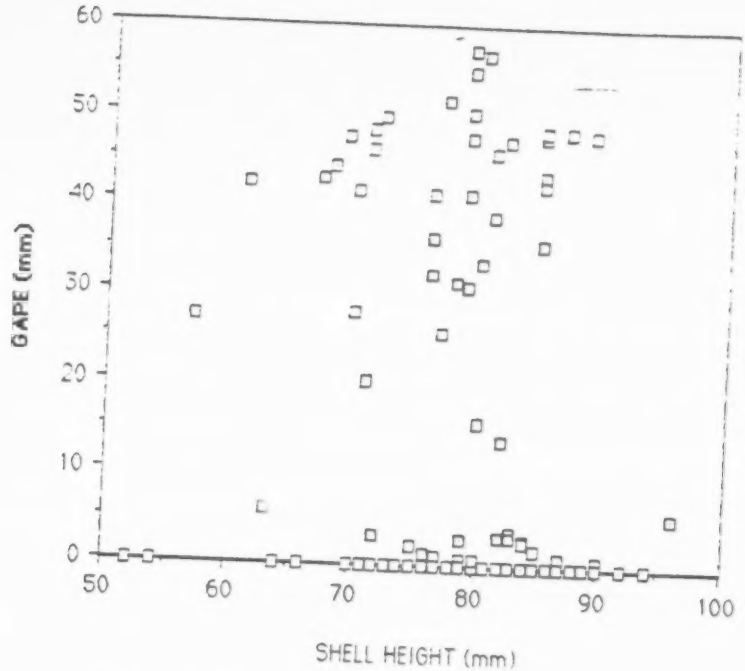

Fig.4. Size (SH)-specific shell gape in Iceland scallop cluckers from Perch Rocks, Placentia Bay, Newfoundland, October 1991.